PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PU030274	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. PCT/US2004/029410	International filing date *(day/month/year)* 10.09.2004	Priority date *(day/month/year)* 23.09.2003
International Patent Classification (IPC) or national classification and IPC H04N7/26		
Applicant THOMSON LICENSING S.A.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 8 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 2 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
11.03.2005	08.02.2006
Name and mailing address of the international preliminary examining authority: European Patent Office - Gitschiner Str. 103 D-10958 Berlin Tel. +49 30 25901 - 0 Fax: +49 30 25901 - 840	Authorized Officer Heising, G Telephone No. +49 30 25901-407

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/US2004/029410

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages	
1-7	as originally filed
Claims, Numbers	
1-11, 13, 14	as originally filed
12	received on 14.03.2005 with letter of 11.03.2005
Claims, Pages	
8, 9	received on 14.03.2005 with letter of 11.03.2005
Drawings, Sheets	
1/5-5/5	as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	2-14
	No:	Claims	1
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-14
Industrial applicability (IA)	Yes:	Claims	1-14
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V.

1 The following documents are referred to in this communication:

D1 : M. SCHLOCKERMANN, S. WITTMANN, T. WEDI, S. KADONO: "Film grain coding in H.264/AVC" JVT OF ISO IEC MPEG AND ITU-T VCEG JVT-I034D2, 2 September 2003 (2003-09-02), pages 1-8, XP002311238 SAN DIEGO, CA, USA

D2 : CHRISTINA GOMILA: "SEI message for film grain encoding: syntax and results" JVT OF ISO IEC MPEG AND ITU-T VCEG JVT-I013 REVISION 2, 2 September 2003 (2003-09-02), pages 1-11, XP002308743 SAN DIEGO, CA, USA

D3 : OHM J-R: "DIGITALE BILDCODIERUNG, VEKTORQUANTISIERUNG VON BILDSIGNALEN" 1995, DIGITALE BILDCODIERUNG. REPRAESENTATION, KOMPRESSION UND UEBERTRAGUNG VON BILDSIGNALEN, BERLIN, SPRINGER, DE, PAGE(S) 233-245 , XP002312555 ISBN: 3-540-58579-6

2 INDEPENDENT CLAIM 1

2.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not new in the sense of Article 33(2) PCT.
Document D3 discloses a well known vector quantiser structure which is suitable "for simulating film grain in an input image block"; please note, that the image content of a film grain block is note defined by the claim and is thus not a feature of the claim (the references in parenthesis applying to this document):

A method for simulating film grain in an input image block, comprising the steps of:
(a) computing an average value of at least one image parameter for the block
(D3: equation 11.2 with block size M'xN' and figure 11.3a with "Mittelwert-Berechnung"),
(b) selecting a film grain block from at least one previously established pool of film grain blocks
(D3: figure 11.3a with inverse vector quantisation given by element VQ^{-1} and page

236, lines 10-12, wherein a residual block is selected by index *j* in the codebook, which contains *J* pre-computed blocks. These codebook blocks contain film grain, if the training set for producing the codebook blocks contained film grain)
whose image parameter most closely matches the image parameter of the input image block
(D3: page 235, lines 12-14, where it is proposed to employ a square error criteria for the selection of the best code block, thus the selected block will match the residual of the input image block as close as possible)
c) blending the selected film grain block with the input image block.
(D3: figure 11.3a, sum of the input image block, which is the mean value block, and the codebook block at the decoder side)

2.2 Furthermore, the present application does not meet the criteria of Article 33(1) PCT, because the subject matter of claim 1 does not involve an inventive step in the sense of Article 33(3)PCT.

Document D1 discloses all features of claim 1, but one feature: it is quiet about the block selection criteria (D1: page 1, paragraph "1. Introduction" and page 2, paragraph "2.2 Film grain coding and duplication").
Since it is well known that the original film grain is signal dependent, the best subjective video quality will be achieved, if the selected grain noise block is adapted to the input image block characteristic. In D1, this can be achieved by adapting the variance *a* of the pre-computed grain block to the local input image signal (D1: page 2, lines 15-16 "The intensity value *a* can depend on local statistics of the decoded image signal".) Since the variance "depends" on the local image characteristics the grain block will not only be modified but also selected for blending with the local input block. The simplest local statistical analysis which can be applied to the input image is the to compute first order statistics, i. e. the block average intensity value. This is a well known criterion for selecting the best grain noise characteristic for the input block characteristic. It is for example used in D2: page 3, last 9 lines, which is cited in D1, to select the local grain noise characteristic which is best adapted to the local input image intensity.
Thus, it does not involve an inventive step to perform the film grain simulation method of D1 by selecting a grain block whose image parameter is most closely matching the

parameter of the input image.

3 INDEPENDENT CLAIM 8

3.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject matter of claim 8 does not involve an inventive step in the sense of Article 33(3) PCT.

3.1.1 Document D1, which is considered to represent the most relevant state of the art to the subject matter of claim 8, discloses (the references in parenthesis applying to this document):

A method for simulating film grain in an input image from which the film grain has at least been attenuated and been decomposed in into input image blocks, comprising the steps of:
(D1: page 1, paragraph "1. Introduction" and page 2, figure 1)

(a) selecting a successive one of a set of input image blocks;
(D1: page 1, paragraph "1. Introduction", lines 13-14 "... to duplicate the decoded film grain to all macroblocks". Thus, a macroblock has to be selected for duplication)

(c) selecting, from among at least one pool of previously established film grain blocks, a film grain block
(D1: page 2, paragraph "2.2 Film grain coding and duplication" describes the film grain block pool generation process. In order to enable the blending process the respective grain block is first selected, implicit feature: page 1, paragraph "1. Introduction", lines 13-14 "... to duplicate the decoded film grain to all macroblocks".)

(d) repeating steps (a)-(c) for all the pixel blocks in the image; and

(D1: page 1, paragraph "1. Introduction" lines 13-14 "... to duplicate the decoded film grain to all macroblocks". Thus, all macroblocks are processed)

(e) blending the selected film grain blocks to yield an output image with film grain.
(D1: page 1, paragraph "1. Introduction", lines 10-11 "... the film grain will be added to the picture content")

3.1.2 The subject-matter of independent claim 8 differs from the disclosure of D1 in that:

(b) computing an average value of at least one image parameter for the successive block;
(c) block selection comprises: having image parameter most closely matches the average value of the at least one image parameter of the successive block;

3.1.3 The problem to be solved by the present invention may therefore be regarded as:

How to select the grain blocks for the different image blocks in order to improve the subjective video quality of the blended output blocks.

3.1.4 In view of D1 and D2 the solution proposed in claim 8 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

D1 is quit about how to select the grain blocks since it is focussing on the creation of the grain blocks for the pool. But, according to D1, the grain blocks should be adapted to the local statistics of the input image. (D1: page 2, lines 15-16 "The intensity value *a* can depend on local statistics of the decoded image signal" and page 2, first equation.) Furthermore, D1 is referencing D2. According to D2 the grain noise for a block is selected whose intensity label (interval) best matches the average intensity value of the input image block under consideration (D2: page 3, line 28 - page 4, line 35).

3.1.5 Therefore, the features disclosed in D1 and D2 would be combined by the skilled person, without exercise of any inventive skills in order to solve the problem posed. The proposed solution in independent claim 8 thus cannot be considered inventive (Article 33(3) PCT).

4 DEPENDENT CLAIMS 2-7 AND 9-14

Dependent claims 2-7 and 9-14 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Article 33(3) PCT), see documents D1-D3 and the corresponding passages cited in the search report. For claims 2 and 14 the relevant citations are: D2, page 4, lines 34-35 "Note..." and D3, page 239, paragraph 2 - page 241, paragraph 1.

5 CLAIMS 1-14

Claims 1-14 disclose methods for film grain simulation for video applications. Therefore, the subject-matter of these claims is considered to be industrially applicable according to Article 33 (4) PCT.

CLAIMS

1. A method for simulating film grain in an input image block, comprising the steps of:

(a) computing an average value of at least one image parameter for the block;

(b) selecting a film grain block from at least one previously established pool of film grain blocks whose image parameter most closely matches the image parameter of the input image block;

(c) blending the selected film grain block with the input image block.

2. The method according to claim 1 further comprising the step of de-blocking the selected film grain block prior to blending with the input image block.

3. The method according to claim 1 wherein the previously established film grain blocks are organized in the at least one pool based on image intensity.

4. The method according to claim 1 further including the step of updating the at least one pool in accordance with characteristics of the input image.

5. The method according to claim 3 where a different film grain block is selected for at least one of a different color component.

6. The method according to claim 1 further including the step of transforming the selected block prior to the blending step.

7. The method according to claim 1 further comprising the step of selecting a film grain block from among a plurality of pools of film grain blocks.

8. A method for simulating film grain in an input image from which the film grain has at least been attenuated and been decomposed in into input image blocks, comprising the steps of:

(a) selecting a successive one of a set of input image blocks;

(b) computing an average value of at least one image parameter for the successive block;

(c) selecting, from among at least one pool of previously established film grain blocks, a film grain block having image parameter most closely matches the average value of the at least one image parameter of the successive block;

(d) repeating steps (a)-(c) for all the pixel blocks in the image; and

(e) blending the selected film grain blocks to yield an output image with film grain.

9. The method according to claim 8 wherein the previously established film grain blocks are organized in the at least one pool based on image intensity.

10. The method according to claim 8 further including the step of updating the at least one pool of pre-established film grain blocks in accordance with characteristics of the input image.

11. The method according to claim 8 where a different film grain block is selected for at least one of a different color component.

12. The method according to claim 8 further including the step of transforming the selected block prior to repeating steps (c) - (d).

13. The method according to claim 8 further comprising the step of selecting a film grain block from among a plurality of pools of film grain blocks.

14. The method according to claim 8 further comprising the step of de-blocking the successive film grain block prior to repeating steps (c) - (d). A method for simulating film grain in an input image block, comprising the steps of:

(a) computing an average value of at least one image parameter for the block;

(b) selecting a film grain block from at least one previously established pool of film grain blocks whose image parameter most closely matches the image parameter of the input image block;

(c) blending the selected film grain block with the input image block.